

UNIV-1100 — First Year Seminar: Scientific Computing Learning Community

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Why Computing

Consider computing in a broad sense - not just *Computer Science*

- Numerical computation (floating point, scientific)
- Discrete computation (integer, exact arithmetic)
- Symbolic computation
- Geometrical computation

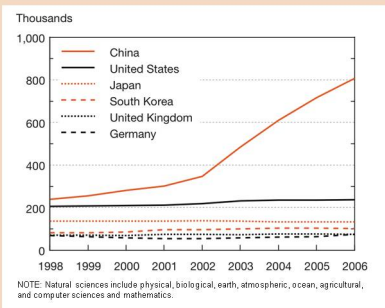
Various reports suggest a shortage of college graduates with STEM (Science, Technology, Engineering, and Mathematics) degrees. This downward trend is an issue of national importance; It affects our capacity to maintain a technological lead in critical skills and disciplines. Our ability to compete in the increasingly internationalized stage will be hindered without college graduates with the ability to understand and innovate cutting edge technologies in the decades to come.

Science and Engineering Trends

Information about science and engineering trends can be found in the NSB's publication *Science and Engineering Indicators: 2010*

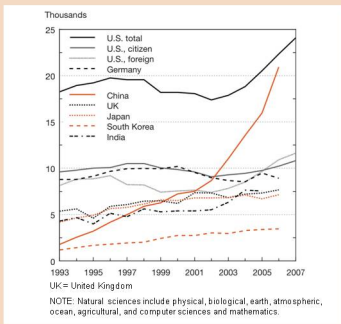
<http://www.nsf.gov/statistics/seind10>

First university degrees in natural sciences and engineering, selected countries: 1998–2006



Science and Engineering Trends

Doctoral degrees in natural sciences and engineering, selected countries: 1993–2007



SOURCE: National Science Board, *Science and Engineering Indicators 2010*



Science and Engineering Trends

More data is available:

- Science and Engineering Indicators
<http://www.nsf.gov/nsb/sei>
- Science and Engineering Indicators (statistics)
<http://www.nsf.gov/statistics/seind>
- STEM Education Data and Trends
<http://www.nsf.gov/nsb/sei/edTool>
- NSB publication
<http://www.nsf.gov/nsb>

NSF - National Science Foundation <http://www.nsf.gov>

NSB - National Science Board <http://www.nsf.gov/nsb>

US Competitiveness and Innovation in the 21st Century

Chuck Vest the president of the National Academy of Engineering (NAE, part of the National Academy of Sciences, NAS) and former president of MIT.

YouTube video



see <http://youtu.be/E3pZtwj4Oul>

The presentation is based in part on the National Academies Press (NAP) publications:

Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future

http://www.nap.edu/catalog.php?record_id=11463

Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5 http://www.nap.edu/catalog.php?record_id=12999

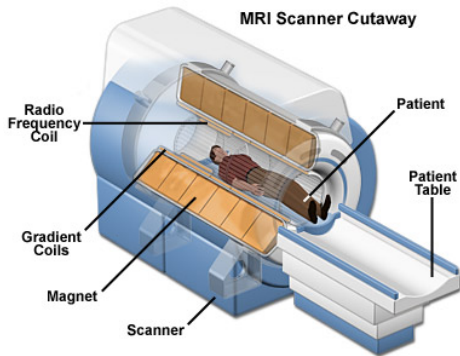
Ubiquity of Computing

- Computing is everywhere
- We rely on computing every day
- Can you name devices that have an embedded computer, or how you rely on computing?

Computing is Everywhere



Computing is Everywhere



Computing is Everywhere



Computing is Everywhere

Your National Weather Service forecast

Auburn AL

Enter Your "City, ST" or zip code

NWS Birmingham, AL Mobile Weather Information | En Español
 Point Forecast: Auburn AL [Similar City Names] Last Update: 3:37 am CDT Aug 24, 2011
 32.6°N 85.48°W Forecast Valid: 9am CDT Aug 24, 2011-6pm CDT Aug 30, 2011

Forecast at a Glance

Today	Tonight	Thursday	Thursday Night	Friday	Friday Night	Saturday	Saturday Night	Sunday
H 92 °F Lo 70 °F	H 93 °F Lo 71 °F	H 94 °F Lo 71 °F	H 94 °F Lo 71 °F	H 94 °F Lo 71 °F	H 92 °F Lo 72 °F	H 92 °F Lo 67 °F	H 91 °F Lo 67 °F	H 91 °F Lo 67 °F

Detailed 7-day Forecast (Move Down)

Today: Sunny, with a high near 92. East wind around 5 mph.

Tonight: Mostly clear, with a low around 70. East wind around 5 mph becoming calm.

Thursday: Mostly sunny, with a high near 93. Calm wind becoming northeast around 5 mph.

Thursday Night: A 10 percent chance of showers after midnight. Partly cloudy, with a low around 71. East wind around 5 mph becoming calm.

Friday: A 20 percent chance of showers and thunderstorms. Mostly sunny, with a high near 94. Calm wind becoming northwest between 5 and 10 mph.

Friday Night: Clear, with a low around 72.

Saturday: Sunny, with a high near 92.

Saturday Night: Clear, with a low around 67.

Sunday: Sunny, with a high near 91.

Sunday Night: Clear, with a low around 67.

Monday: Sunny, with a high near 92.

Monday Night: Clear, with a low around 69.

Tuesday: Sunny, with a high near 93.

Current Conditions (Move Down)

Auburn-Opelika Airport
 Lat: 32.62 Lon: -85.44 Elev: 774
 Last Update on Aug 24, 8:15 am CDT

Fair	Humidity: 79 %
77 °F (25 °C)	Wind Speed: E 5 MPH
	Barometer: 30.02
	Dewpoint: 70 °F (21 °C)
	Heat Index: 79 °F (26 °C)
	Visibility: 10.00 mi.

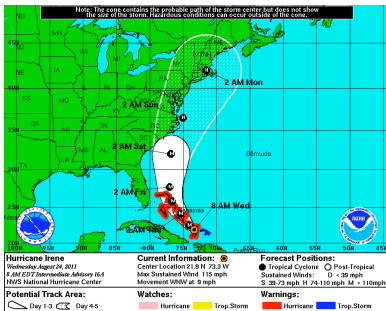
[More Local Wx](#) [3 Day History](#)

Radar and Satellite Images

Detailed Point Forecast (Move Up)

[Click Map for Forecast](#) [Disclaimer](#)

Map Satellite Terrain



Computer Performance

- Speed

- Clock speed - MHz or GHz (megahertz or gigahertz, 10^6 , or 10^9 HZ, Hertz, cycles per second)
- Computing speed - MFlops, GFlops, TeraFlops, or PetaFlops (10^6 , 10^9 , 10^{12} , or 10^{15} floating point operations per second)
- Communication bandwidth - Bus, switch, or interconnect bandwidth MB/s or GB/s (megabytes or gigabytes per second, 10^6 or 10^9 bytes per second)

- Size

- Number of processors or cores (processing units)
- Cache size
- Memory size
- Disk size
 - MB, GB, or TB (megabytes, gigabytes, or terabytes, 10^6 , 10^9 , or 10^{12} bytes)

History and Future of Computing

My personal experience...

Then (1990):



One 20MHz processor, 8MB memory, two 104MB disk drives, and a 3.5" 1.44MB floppy disk drive.

Now (2010):



Two 2.93GHz 6-core processors, 16GB memory, a 1TB disk drive, and a double layer DVD drive (approx. 8.5GB).